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THE HORN SPEAKER

Fig. 10. Operating a two control regenerative vacuum tube receiving set. The left knob and dial is employed to tune with, while the right knob and dial controls regeneration.

Installing a Radio Set

By A. P. PECK

IN all of the former articles appearing in this section, for the beginner, the greatest consideration was given to the person who, more or less mechanically inclined, desired to build his own set and needed simple, explicit directions for doing so. The man buying a complete set has, to date, been somewhat neglected. Bearing this in mind, the author will, in this and future articles, take this division of the radio fans more into consideration. The present article and the illustrations accompanying it will be of interest to all; the builder and the buyer as well. Here will be found directions for putting a radio set into efficient operation, regardless of its type. The directions will hold for any set, although a one tube outfit will be considered in detail.

The first consideration is, of course, the antenna or aerial. This is the collection of outside wires with which we are all familiar since they may be seen on many housetops in every city, town and village. The one thing to bear in mind in connection with this part of the set is that the aerial should be as high as possible and its length between 75 and 100 feet. The wire to be used can be bought from any radio, electrical or hardware store. It should be copper, either one solid strand or several strands twisted together. The latter is the stronger and should be used in locations where high winds are likely to be encountered. The size should be what is known as No. 14 B. & S. gauge. It may be strung between any two convenient points, usually between a tree or a specially erected pole, and the house.

At each end of the wire, what is known as an insulator should be fastened. The purpose of this is to prevent the weak currents collected by the antenna from leaking off to the ground. These insulators serve the same purpose as those placed on telephone poles and are similar in material. They are made of porcelain or some kind of insulating compound and are provided with a ring at each end. These insulators may be bought in any radio store. The hole is placed in the insulators so that the wires can be fastened thereto. The procedure is as follows: Push about six inches of the end of the aerial wire through one of the holes, bend it back on itself and twist the end of the wire tightly around the long portion. Do the same at the other end of the aerial. Now, attach the wire or ropes that are to support the aerial to the other holes in the two insulators.

THE LEAD-IN

It is necessary that the aerial be connected to the radio set in such a way that the currents collected by it can go to the set in the shortest manner so that the signals or music and voices will reproduce best. For this it is necessary that a wire known as the lead-in be provided. It is attached at one end to the aerial and to the radio set at the other end. The aerial connection is made at a point just a few inches from the insulator on the end of the aerial nearest the house. Here the aerial and the lead-in wires are scraped carefully until they are bright and clean and the lead-in wire wrapped tightly around the aerial. If you are proficient at soldering, solder this joint. If not, wrap two or three layers of tinfoil tightly around the joint, extending the wrapping an inch on either side of the twisted wires. Then cover the tinfoil with a layer of friction tape and paint the tape with shellac. This will give a tight joint that will resist the weather and will not corrode.

Another very good way to fasten the aerial to the insulator and at the same time have a good lead-in is to use one single length of wire for both the aerial and the lead-in. In this method an insulator is fastened to one end of the wire. Measure off the length of the aerial on the wire and mark that point. Slip the other end of the wire through one of the ends of the remaining insulator until the ring comes to the point marked on the wire. Bend the wire back and twist it three or four times around the portion of the wire leading to the insulator. The loose end then forms the lead-in and no joint is necessary. When a long length of wire is available, this is the preferred method of fastening the lead-in.

After the insulators are fastened in place and the lead-in attached, you are ready to pull up the aerial. It is desirable to use ropes for supporting the aerial and to place pulleys where the aerial is to be fastened. The ropes can then be run through the pulleys and the aerial raised or lowered when repairs or changes are to be made.

THE LIGHTNING ARRESTER

If you have selected the place for the aerial properly, the lead-in will hang near the window of the room where the radio set is to be located. Here is the spot to place the lightning arrester. Several types are available, some to be attached to the wall of the house and others to the window frame. Both types are illustrated in Fig. 1. Any arrester stamped

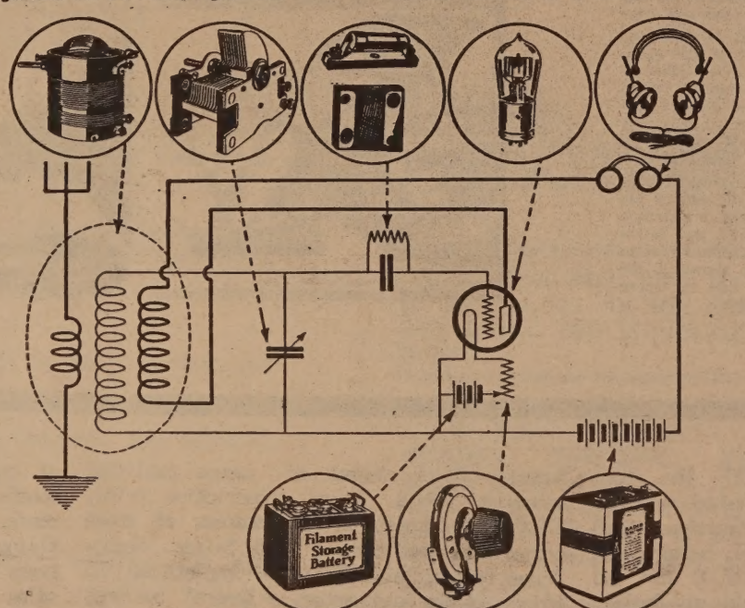


Fig. 11. The circuit diagram of a two control single tube regenerative receiver with the instruments shown in both symbolic and picture form.

The coupler shown in the top left hand circle has two windings on the outside tube. The primary which is in the lower one, is connected between the antenna and the ground and the upper one, which is the secondary is connected to the grid condenser and positive filament of the tube. The tickler coil, which is mounted so that it may be rotated, is connected between the plate of the tube and the phones. In the next circle is a variable condenser, which is connected across the secondary of the coupler. The lower binding post of the condenser is connected to the filament side of the secondary coil and the upper binding post or stationary plates go to the grid condenser end of the secondary. In the next circle there are the grid condenser and leak which are connected together and then one side run to the variable condenser and the other to the grid of the tube. The tube socket used to make connections with the elements of the tube is not shown. The phones shown next are connected to the plus side of the "B" battery, which is in the lower right hand circle. The minus side of this battery is connected to the plus side of the storage battery, the current supplied by this being varied by the rheostat in the middle circle.

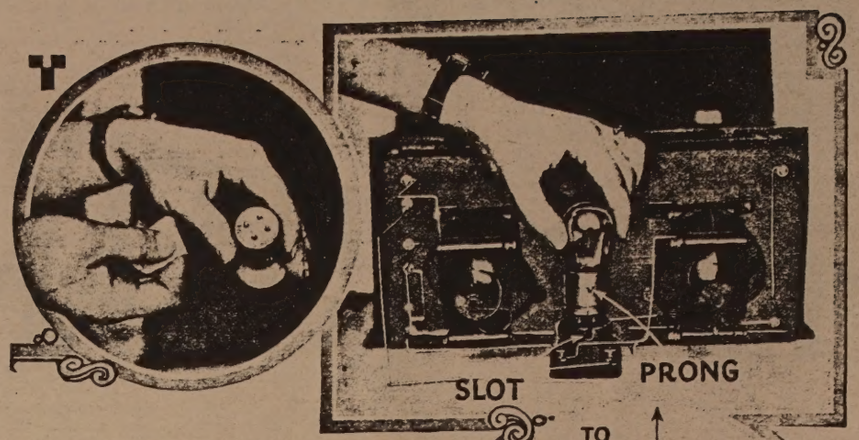
as having been approved by the Board of Fire Underwriters is good and can be bought with perfect confidence. The type will depend on the particular place in which you wish to put it. It will be found convenient also to purchase what is known as a lead-in strip. More of this later.

PROTECTION

You will undoubtedly want to know if a lightning arrester will really arrest lightning. No, it will not, nor is it intended to do so, even if the name does imply that it should. The usual types of arresters consist of two metal points, placed close together in a glass tube from which all of the air has been removed. It is an established fact that a current of electricity will jump between two points very easily when there is no air present. This fact is made use of in a lightning arrester. The arrester works as follows: During a thunder storm, the air is full of electricity. If the aerial is not connected directly to the ground or to the ground through an arrester, this electricity will collect on the aerial and build up until it is strong enough to work damage to the set. It is out of the question to have the aerial connected to the ground at all times, as we would not be able to receive radio messages. At one time we used a switch to connect the aerial to the ground, but too often, the switch was forgotten. So now we use the arresters described above. The electricity collecting on the aerial jumps across the gap in the arrester and goes to the ground before it gets a chance to build up to a dangerous point. The radio currents, being very weak, cannot cross the gap; therefore, they go to the radio set and give us the messages.

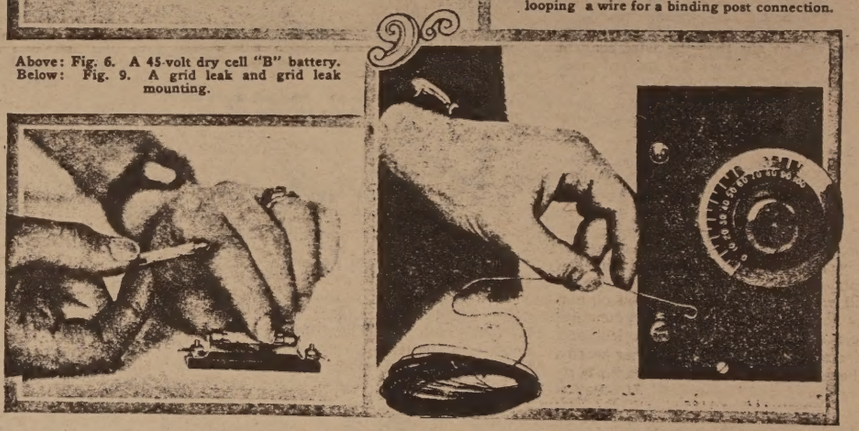
DIRECTIONS

The lightning arrester should be mounted outside the window. Directions accompany each arrester and show where to connect the lead-in, the wire that is connected to a water pipe or other metal object running to the ground and the wire that is to be connected to the set. After making these connections, place the lead-in strip that was mentioned above, over the window sill and close the window on it. The strip will conform to the shape of the sill, as shown in Fig. 2. To the outside end of the strip, fasten the wire connecting to the arrester, indicated as being the one to connect to the radio set. To the inside end of the strip connect a piece of copper wire which is covered with either cotton, rubber or some other insulating material and lead that wire to the table where the radio set is placed. Scrape the insulation from the end of the wire, (this must always be done in making a connection with insulated wire), and fasten it to the aerial binding post on the set, after having bent it to the shape shown in the photo of Fig. 3. Be sure that the curve is bent to the right as shown. This is



Above: Fig. 7. Cleaning the prongs of the vacuum tube with a piece of sandpaper. Above right: Fig. 8. Correct method of inserting the tube into the socket.

Above: Fig. 1. Two types of lightning arresters and how an arrester is connected up. Below: Fig. 3. Correct method of looping a wire for a binding post connection.



Above: Fig. 6. A 45-volt dry cell "B" battery. Below: Fig. 9. A grid leak and grid leak mounting.

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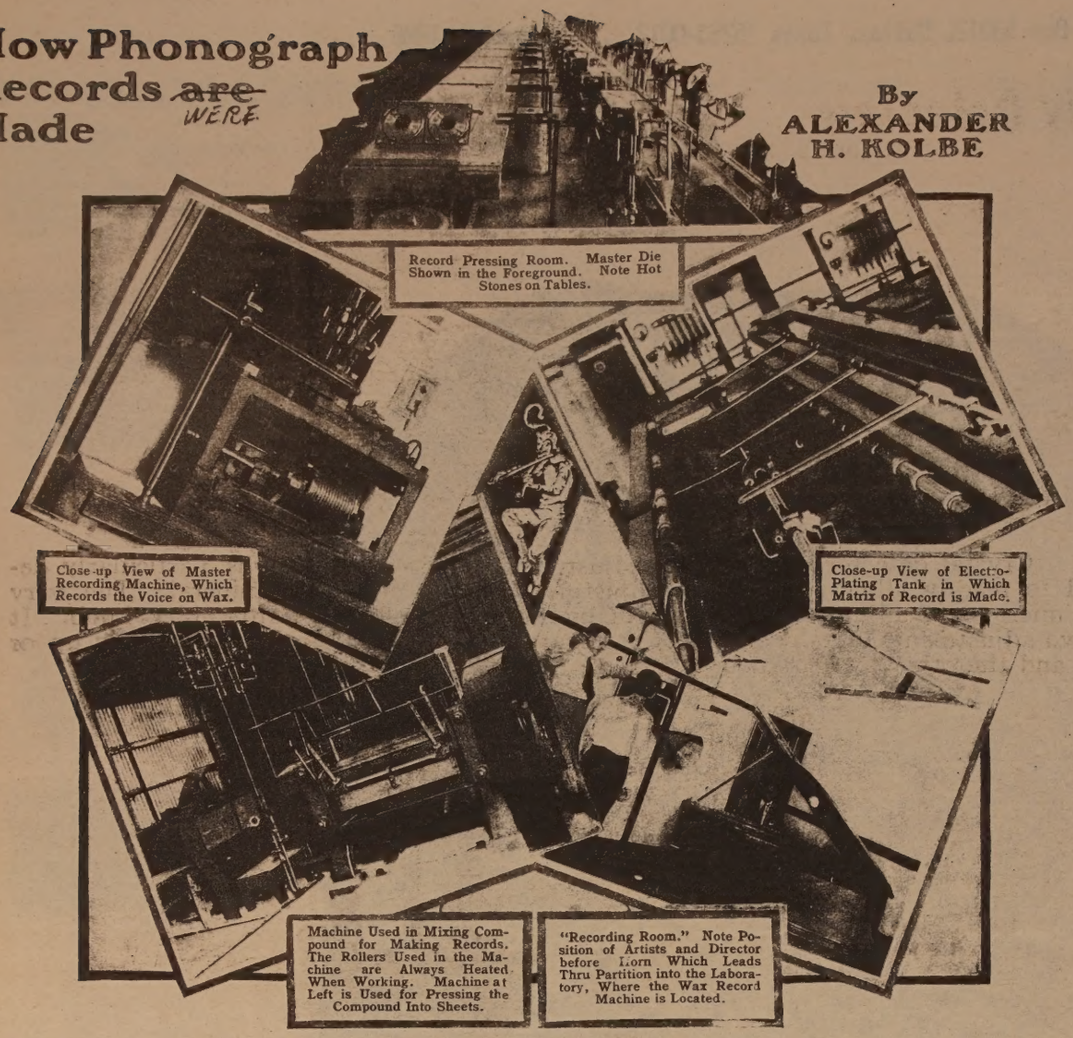
How Phonograph Records ~~are~~ WERE Made

By ALEXANDER H. KOLBE



Record Pressing Room. Master Die Shown in the Foreground. Note Hot Stones on Tables.

Close-up View of Master Recording Machine, Which Records the Voice on Wax.

Close-up View of Electro-Plating Tank in Which Matrix of Record is Made.

Machine Used in Mixing Compound for Making Records. The Rollers Used in the Machine are Always Heated When Working. Machine at Left is Used for Pressing the Compound Into Sheets.

"Recording Room." Note Position of Artists and Director before Horn Which Leads Thru Partition into the Laboratory, Where the Wax Record Machine is Located.

PHONOGRAPH record making is an art, and it is with great care, difficulty and expense that they are produced by the American manufacturers. Thru the kind and able assistance of Mr. A. C. P. Russen, Newark, N. J., engineer and expert on machinery for making not only phonograph records, but music rolls, this article together with the accompanying illustrations was made possible.

Manufacturers of phonograph records absolutely refuse to disclose their secret of making such discs. For this reason alone, photographs have never before been published in this country in connection with an article such as this. The many excuses given out are that every maker of phonograph records, design their own machinery, lay out their own electrical apparatus and often use special mechanical and automatic machines of their own invention.

Talking to the "First" Record

The first step in the manufacture of a phonograph record is the making of original wax discs which are about one-half inch larger in diameter than the finished record to be produced and about three-quarters of an inch thick. These discs are formed by using a fairly soft composition of wax. The original wax discs are placed on the recording machine, which to all purposes is a phonograph except that it is more delicate in construction and that the action of the needle is reversed, that is, instead of the needle falling into a groove, it is forced by the transmitting diafram into the soft wax.

Let us now consider the making of this first impression. The recording room is so arranged that the best results will be obtained. The recording machine is placed in a separate room and only the receiving horns project into the recording room. Special attention is given to the seating arrangements in the recording room. Seats for the orchestra are arranged in a semi-circle. Each chair differs in height to suit the needs of the individual instruments to be played in order that the air vibrations will be most effective in registering thru the diafram on the recorder. In making vocal selections, special attention is given to the distance separating the singer and the machine.

How a Matrix Is Made

The most important factor in the making of records is the first soft wax record or master. The impressions on the wax are very delicate and therefore the record could not be used directly in producing other records. The next step in the manufacture of records is carried out in what we shall term the electrolytic department. The equipment in this department consists of large rectangular tubs lined with lead and filled with a solution the same as used for electrotyping. Suspended on two round brass rods running across these tubs are anodes, usually copper plates, with two wires hooked over the rods, making it possible for the entire plate to be submerged in the solution. Parallel with these bars and midway between is another round bar of the same size on which swivel-connections, evenly distanced apart, are located. Suspended vertically from each of these swivels is a small rod with a long end hanging into the solution below the swivel, and a short end above the solution and the swivel. At the ends of these rods in the solution are the wax discs. See diagram herewith.

The object of the above arrangement is to have the discs maintain a continuous pendulum motion in the solution. This motion is produced by a rod which continuously moves back and forth.

To explain how the small particles of copper are taken from copper plates or anodes and deposited on the wax discs would involve a scientific discussion of great length. It is sufficient to know that the action is due to the electric current plus the chemical action of the solution. The electric current, circulating thru the anode bar and anodes over and across to the wax discs hanging on the swivel arm, carries small particles of copper and deposits them on the wax discs with such close adhesion that they pile up in a mass over the face and grooves of the wax record.

Great care is exercised in keeping up an even, continuous flow of electric current. After an immersion of twenty-four hours the wax record is covered with a coating or sheet of copper. The copper sheet is stript off very carefully and the rough edges of the copper discs are trimmed off that portion which projects outside and beyond the diameter of the wax discs. This disc becomes the master matrix and from it reverse duplicates are produced. The copper impressions stand out on the master matrix where they are deprest in the wax record.

Making a Matrix from a Matrix

After coating the back and edges of the master matrix with wax so that the copper particles will cling only to the part not waxed, these impressions are suspended in the same manner as the original wax disc. After twenty-four hours the discs are stripped again, the same operations being carried out. The second copper disc is called the mother matrix, and by treating the mother matrix the same as the master matrix there is produced what is termed the pressing matrix. The latter is used to press records for the trade. The master matrix is carefully guarded by the producing concern. These steps are all shown in the accompanying diagram.

The product, after passing thru these stages of manufacture is ready for the pressroom. In this department there is a steam rolling mill consisting of two or three steam-heated rollers supported in proper frames and driven by gearing. On the top of this machine there is a hopper into which the composition entering into the finished product is placed. The materials used in the ordinary black record consist chiefly of shellac with portions of rotten stone and lampblack. These are carefully pulverized and screened free from metal or other foreign matter. The composition is placed in the hopper and heated and mixed by the rolls to a consistency a little stiffer than bread dough.

Great care is exercised to get a resultant mixture that will produce a hard, glossy record impervious to slight changes of temperature. A mixture too soft would tend to warp records.

The mixture is flattened out into strips by another set of heated rolls. Rectangular strips about five inches wide and 3-16 of an inch thick are cut and sent to the pressroom. These strips are placed between dies consisting of two square steel plates into the faces of which round depressions have been turned equal in depth to one-half of the thickness of the finished record plus the thickness of the copper matrix. A separate lipt ring holds the matrix by its outer edge face up, so that when this ring is screwed down the matrix becomes a part of the one-half mold.

(Continued on page 8)

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GRACIOUS, WHAT NEXT?

A smooth advertisement from the *Oil City* (Pa.) *Derrick* of June 14: "A ONE TUBE RADIO HEAD - SET; batteries complete, $10." Evidently these head-sets are for receivers that have insufficient amplification. It is predicted that they will have a great sale among crystal set addicts.

Contributed by H. W. Slingluff.

CHEAP AT HALF THE PRICE

Real estate gesture from the *New York Sun* of May 29: "Radiola super-heterodyne portable for sale, complete with HOME and portable batteries." There's no price mentioned, but whatever it is, it would be cheap. This is an excellent opportunity for newlywed fans who wish to settle down.

Contributed by B. Murphy.

THIS IS DEEP STUFF

Advance notice of an event that will doubtless cause a rush similar to the "49ers" to Calif., in the *Birmingham* (Ala.) *News* of May 23. "MINERS GET RADIO 2,100 FEET DEEP." This looks as if the manufacturers of sets will have to go out of business, if they can dig up receivers like this.

Contributed by Donald Ellis.

HAIL, HAIL, THE GANG'S ALL HERE!

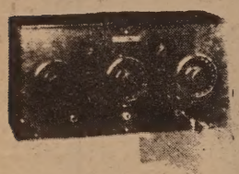
Bright idea set forth in the June 2 issue of the *Pittsburgh Post:* "Each set of inductance is CELEBRATED so that accurate tuning may be made." Our guess is that a few coils have been named for Marconi, Hertz, de Forest, Armstrong, etc., and that they make a great combination for DX receiving.

Contributed by C. F. Neumann.

CLARION JR., one of the best small working radios that is able to reproduce good clean audio and represent its year, 1930, a time of "peephole" dials and curved tops. This old timer not only has screen grid tubes and a push-pull audio, but an electro-dynamic speaker.

TRADE NAME: Freshman Masterpiece.
TYPE: Self-balanced tuned radio frequency receiver.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $60.00.
MANUFACTURER'S NAME: Chas. Freshman Co., Inc.

TRADE NAME: "Garod."
MODEL: RAF.
TYPE: Neutrodyne.
TUBES: Four.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Outside or Inside.
PRICE: $135.00 without accessories.
MANUFACTURER'S NAME: Garod Corporation.



TRADE NAME: "Garod."
MODEL: V.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $195.00 without accessories.
MANUFACTURER'S NAME: Garod Corporation.

TRADE NAME: "Giblin Broadcast."
MODEL: RL.
TYPE: Two radio frequency, detector and three audio.
TUBES: Six.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: Standard Radio and Electric Corporation.

TRADE NAME: "Giblin Phonograph Broadcast Receiver."
MODEL: T14.
TYPE: Radio frequency with loop aerial.
TUBES: Two radio, detector and two audio.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts.
CONTROLS: Two.
ANTENNA: Loop.
PRICE: $425.00 without accessories.
MANUFACTURER'S NAME: Standard Radio and Electric Corporation.

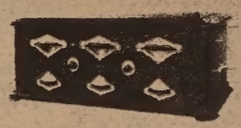
TRADE NAME: "Giblin Broadcast Receiver."
MODEL: C.
TYPE: Coupled radio frequency.
TUBES: Six, 2 radio frequency, detector and 3 audio frequency.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts; space provided for batteries in cabinet.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $185.00 with loud speaker.
MANUFACTURER'S NAME: Standard Radio and Electric Company.

TRADE NAME: "Giblin Broadcast Receiver."
MODEL: 2RA3.
TYPE: Coupled radio frequency.
TUBES: Six, 2 radio frequency, detector and 3 audio frequency amplifiers.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $110.00 without accessories.
MANUFACTURER'S NAME: Standard Radio and Electric Company.

TRADE NAME: "Gilfillan."
MODEL: GN-2.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $140.00.
MANUFACTURER'S NAME: Gilfillan, Inc.

TRADE NAME: "Gilfillan."
MODEL: GN-1.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $175.00 without accessories.
MANUFACTURER'S NAME: Gilfillan, Inc.

TRADE NAME: "Grandette."
MODEL: V-50.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: R. E. Thompson Mfg. Co.



TRADE NAME: Grebe Synchrophase.
MODEL:
TYPE: Two tuned radio, detector and two audio, last stage parallel tubes.
TUBES: Six 199 type.
BATTERIES: None furnished.
ANTENNA: Inside or outside.
CONTROLS: 3.
PRICE: $155.00.
MANUFACTURER'S NAME: A. H. Grebe & Co.
NOTE: This same set furnished with tubes of the 201A type (Model NU-1).

TRADE NAME: Grebe Synchrophase.
MODEL: NU-2.
TYPE: Two tuned radio, detector, and two audio, last stage parallel; with battery case.
TUBES: Six 199 type.
BATTERIES: None furnished.
ANTENNA: Inside or outside.
CONTROLS: 3.
PRICE: $170.00.
MANUFACTURER'S NAME: A. H. Grebe & Co.
NOTE: This same set furnished with tubes 201A type (Model NU-1).

1925 battery radios, listed serially from month to month.

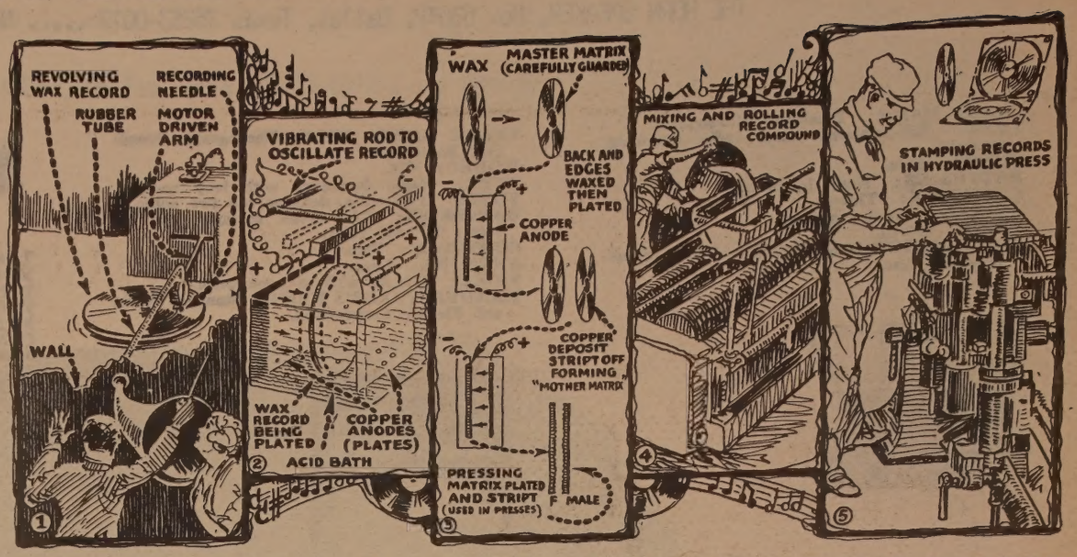
Records Are Stamped in Presses

The composition squares of shellac stock are cut into smaller squares. These pieces are laid on a warming plate until warm enough to proceed. Then the printed paper circle is placed over the central pin face down, and later face up, in the die against the matrix. A hole is then punched into the soft composition. Both halves are placed together and kept in position by the central pin and two dowels.

The complete die is placed in the hydraulic press, the dies being warm and the stock pliable. As the two half-dies are prest together, the lump of stock is flattened until it flows to fill the entire opening plus a little that overflows, the latter forming a slight fin around the outside edge of the record midway of its thickness.

The tables of the hydraulic presses are raised by water pressure coming from a small pump producing 500 pounds pressure to the square inch. Each record is therefore subjected to from 40,000 to 50,000 pounds total pressure.

The finished record is placed in a trimming lathe and the fin or overflow is shaped off. After this process the record is tested on an ordinary phonograph. After testing and labeling the records are ready for the trade.

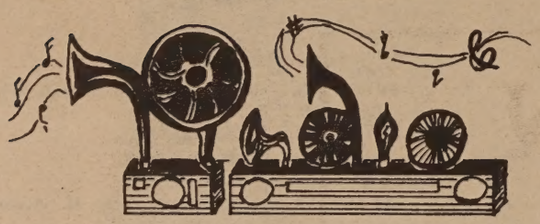


The Pictures Above, Viewed from Left to Right, Illustrate the Successive Steps Followed in Making Phonograph Records. The Original Wax Record on Which the Music is First Recorded, is Placed in an Electro-Plating Bath; Fig. 3 Shows How the Copper Deposit is Stript Off, and This in Turn Placed in an Electro-Plating Bath, the Second Matrix Being Stript Off and Used as the Stamping Die in Producing the Records, as Shown at Fig. 5.

Science and Invention for December, 1921

the ellis county museum presents

THE

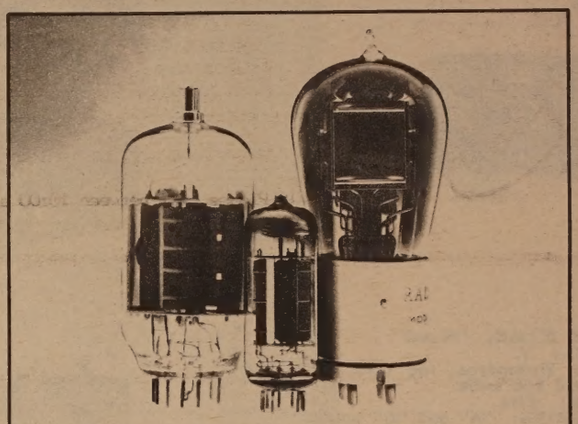


YEARS

Steve Chapman, radio collector and prominent attorney in Waxahachie, and The Ellis County Museum are exhibiting some of the finest sets of broadcast history. The displays include fine classic radios like Kennedy and Scott.

The museum is located in downtown Waxahachie, which is just south of Dallas on the way to Austin, Texas.

OCTOBER 16 - NOVEMBER 30



TUBES — 2,000 TYPES DISCOUNT PRICES!

20-pg. wholesale catalog for the radio collector/hobbyist. Antique, hard-to-find and modern tubes. Also transformers, capacitors and parts for tube equipment, and books, etc.

ANTIQUE ELECTRONIC SUPPLY

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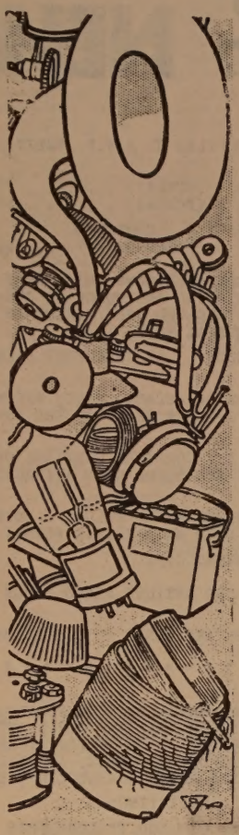

OLDE TYME RADIO CO.

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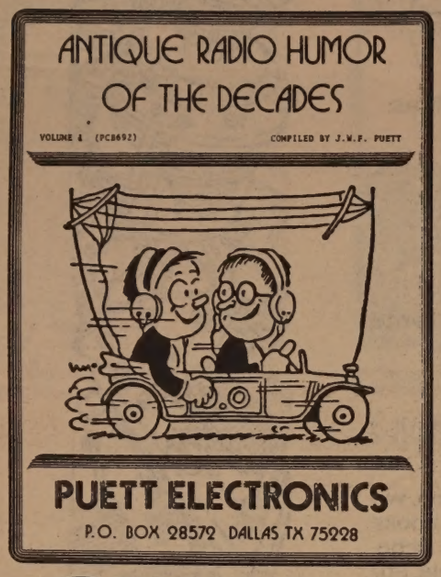

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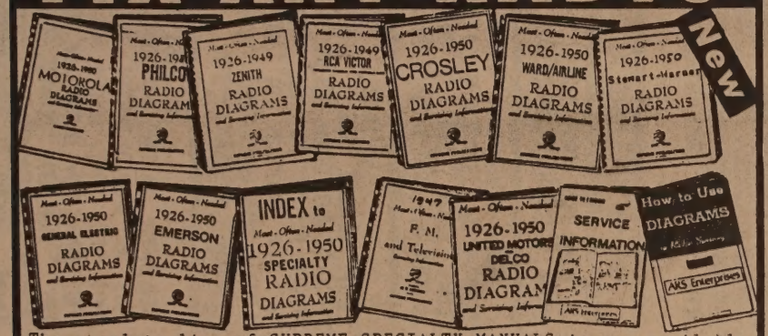

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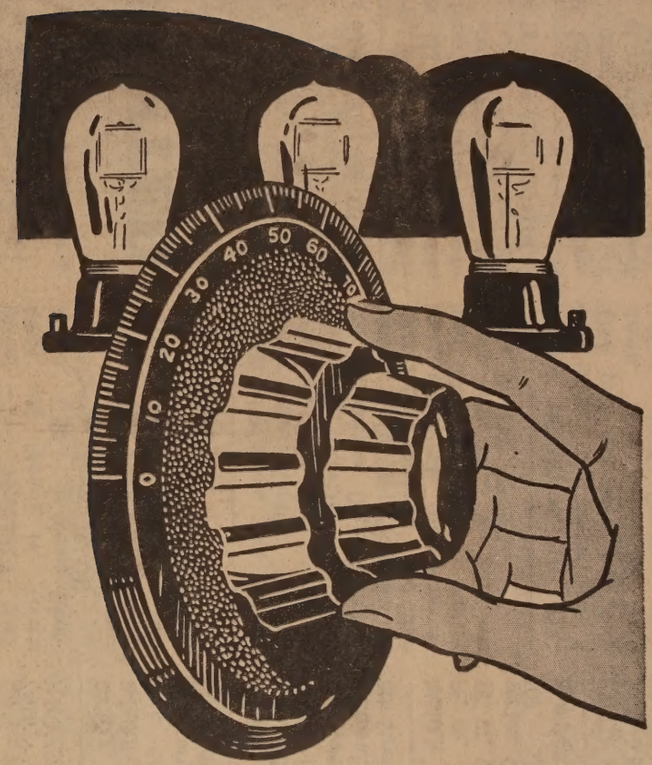

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